SPECIFICATION

CLEANING DEVICE FOR A HAIR REMOVING APPARATUS

TECHNICAL FIELD

The present invention is directed to a cleaning device for a hair removing apparatus, particularly a dry shaver with the use of a cleaning liquid.

BACKGROUND ART

U.S. Patent No. 6,263,890 shows a cleaning device for a dry shaver. The device is formed with a basin for accommodating therein a shaver head of the shaver, and a tank containing a volume of a cleaning liquid and communicating with the basin through a liquid supply channel. A pump is disposed in the liquid supply channel in order to supply the liquid from the tank into the basin for cleaning the shaver head, i.e., cutters and the associated parts. The tank is disposed immediately below the basin for collecting the liquid from the basin by gravity feed. As the tank is required to hold a large volume of the liquid for supplying it to the basin in an amount enough for cleaning the shaver head, the tank is inherently made bulky and therefore adds an extra height to the cleaning device, which detracts from design flexibility.

U.S. Patent No. 5,711,328 suggests another cleaning device in which the pump is disposed between the basin and the tank in order to feed the liquid back into the tank from the basin and to supply the liquid from the tank to the basin. The tank is itself made as a hermetically sealed container to accumulate the liquid from the basin. When the basin is empty or becomes exhausted, an outside air is introduced into a fluid channel leading from the basin to the tank and is collected also in the tank. The air is accumulated in the tank to give an

increased air pressure by which the liquid in the tank is forced to expel into the basin. Thus, the liquid can be constantly circulated between the basin and the tank. With this scheme, however, it is difficult or even impracticable to make the basin completely empty, i.e., to collect the entire liquid from the basin into the tank. That is, as the basin becomes nearly empty, the air is fed into the tank to increase the air pressure which, in turn, expels the liquid out of the tank into the tank. Thus, the basin is always filled with the liquid and could not be totally exhausted by the pump. Consequently, the liquid could not be wholly recovered into the tank and suffers from unintended evaporation until a later cleaning operation.

DISCLOSURE OF THE INVENTION

The present invention has been accomplished in view of the above problems and provides an improved cleaning device for a hair removing apparatus. The cleaning device in accordance with the present invention has a housing configure to hold the hair removing apparatus. The housing is formed with a basin for accommodating therein an operator head of the apparatus, and carries a tank containing a volume of a cleaning liquid. A supplying mechanism is included to supply the cleaning liquid from the tank to the basin for clearing the operator head. The tank has an inlet and an outlet. The inlet communicates with the basin by way of a fluid intake channel that opens to the atmosphere so as to permit the entry of an outside air, while the outlet communicates with a liquid supply channel for dispensing the liquid into the basin. The supplying mechanism includes a pump disposed in either one of the fluid intake channel and the liquid supply channel in order to draw the cleaning liquid from the basin

and the air into the tank as well as to supply the cleaning liquid from the tank into the basin. The important feature of the present invention resides in that the tank is in the form of a hermetically sealed container which is selectively open to the atmosphere by way of an air valve, and that the device includes a controller which selectively gives a supply mode for supplying the liquid to the basin from the tank and a recovery mode for recovering the liquid from the basin to the tank. The controller controls to open and close the air valve while actuating the pump, thereby enabling one of the supply mode and the recovery mode, selectively. Due to the provision of the air valve and the controller selectively closing and opening the air valve, the liquid can be recovered successfully into the tank from the basin after cleaning the operator head only with the use of a single pump, leaving substantially no liquid in the basin.

In a preferred embodiment, the pump is disposed in the fluid intake channel to give the supply mode and the recovery mode in association with the control of the air valve. In the supply mode, the controller actuates the pump while keeping the air valve closed so as to feed the air through the fluid intake channel into the tank and accumulate the air pressure within the tank, thereby forcing the liquid out of the tank to the basin under the action of the increased air pressure. In the recovery mode, the controller actuates the pump while keeping the air valve opened so as to collect the liquid out of the basin through the fluid intake channel into the tank without accumulating the air pressure within the tank, thereby collecting the liquid successfully into the tank.

Preferably, the air valve is an electromagnetic valve that closes and opens selectively under the control of said controller.

The device may also include a drip pan that is disposed immediately

below the basin to receive the liquid dripping from the basin. The drip pan is open to the atmosphere and is connected to the fluid intake channel such that the cleaning liquid and/or the air are drawn into the tank.

The basin is formed in its bottom with a drain port through which the liquid dribbles into the drip pan together with contaminants dislodged from the operator head. The drip pan is preferably provided with a filter that passes the liquid removed of the contaminants into the tank in order to keep the tank free from the contaminants.

Most preferably, the drip pan is defined by a drawer removably received within a recess in the housing below the basin. The drawer is formed with an opening in fluid communication with the drain port of the basing and with a connection port for detachable connection with the fluid intake channel. The filter being fixed to said drawer at a position between the opening and said connection port. With this arrangement, it is easy to take the contaminants away from a circulating path between the basin and the tank, thereby keeping the liquid clean for prolonged use.

The tank may be detachably mounted on the housing so that it can be washed as necessary or replaced with a fresh one.

The air valve is mounted on the side of the housing and communicates with the tank through an air exhaust channel. The housing is configured to incorporate the fluid intake channel, the air exhaust channel, and a liquid supply channel leading to the basin. While, on the other hand, the tank is integrally formed with an air exhaust tube for detachable connection with the air exhaust channel, a liquid outlet tube extending from the outlet for detachable connection with the liquid supply channel, and a fluid inlet tube extending from the inlet for

detachable connection with the fluid intake channel. Thus, the tank can be successfully made detachable to the housing.

The housing is preferred to have a stand giving a mounting face on which the tank is attached. The mounting face is formed at the top end of the housing and includes sockets for detachable connection respectively with the air exhaust tube, the liquid outlet tube, and the fluid inlet tube. The sockets are oriented upwardly with respect to a height axis of the housing such that the tank is mounted on the stand from the above, thereby facilitating the mounding and demounting of the tank, yet avoiding accidental leakage of the liquid possibly remaining in the liquid supply channel and the fluid intake channel on the side of the housing.

Preferably, the tank has in its top end a filling port sealed with a detachable cap in order to replenish the liquid as necessary with the tank mounted on the housing.

In a preferred embodiment, the housing is provided with electrical contact means for connection with an electric circuit of the hair removing apparatus. The electrical contact means is connected within the housing to the controller for transmitting a signal that energizes the hair removing apparatus. Thus, the operator head of the apparatus can be actuated while being exposed to the cleaning liquid for facilitating the cleaning, in addition to that the hair removing apparatus can be charged when it is powered by a rechargeable battery.

In this connection, the housing may include a retainer that holds the apparatus in position for reliable electrical connection between the electrical contact means and the electric circuit in the hair removing apparatus. The contact means includes a plurality of contacts exposed on the exterior of the

housing. The retainer is configured to apply a force of pressing the contacts against corresponding terminals formed on the exterior of the apparatus.

Preferably, the basin is provided at the lower end of the housing with respect to the height axis or dimension, while the tank is provided on the housing at a location laterally spaced from the basin in such a relation that the tank overlaps with the hair removing apparatus along the height axis of the housing.

Alternatively, the tank may be shaped to have a vertical section and a horizontal section and a horizontal section. The vertical section is disposed at a location laterally spaced from said basin with respect to said height axis in such a relation that said tank overlaps with the hair removing apparatus along said height axis, and that the horizontal section being disposed below said basin. Thus, the tank can be shaped relatively freely and disposed at a suitable position, improving design flexibility of the device.

Further, the device may be configured to dispose the pump in the liquid supply channel and to dispose the air valve in an air exhaust channel leading from the tank and margining the liquid supply channel at the pump. In addition, a liquid feed valve is disposed in the liquid supply channel between the pump and the tank, and is caused by the controller to open and close selectively in association with the air valve. In this modification, the supply mode is defined to actuate the pump while keeping the air valve closed and at the same time the liquid feed valve opened, thereby drawing the liquid from the tank and supplying it into the basin. On the other hand, the recovery mode is defined to actuate the pump while keeping the air valve opened and at the same time the liquid feed valve closed, thereby vacuuming the tank to draw the liquid out from the basin into the tank without feeding the liquid out of the tank.

These and still other advantageous features of the present invention will become more apparent from the following detailed description of the embodiment when taken in conjunction with the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a cleaning device shown with a dry shaver in accordance with a preferred embodiment of the present invention;

FIG. 2 is a schematic view illustrating the operation of the above device;

FIG. 3 is a rear perspective view of the above device in a rather schematic representation;

FIG. 4 is a front view of the dry shaver;

FIG. 5 is a circuit block diagram of the above device illustrating the operation of the above device;

FIG. 6 is a front perspective view of the above device with the dry shaver being removed therefrom;

FIGS. 7 and 8 are vertical sections of the above device, respectively with and without the shaver;

FIG. 9 is another vertical section of the above device;

FIG. 10 is a rear vertical section of the above device;

FIG. 11 is a front view of the above device;

FIG. 12 is a vertical section of a detachable tank utilized in the above device;

FIG. 13 is a top view of a drip pan utilized in the above device;

FIG. 14 is a vertical section of the drip pan;

FIG. 15 is a vertical section of an alternative drip pan which may be utilized in the above device;

FIG. 16 is a schematic view illustrating a modification of the above device;

FIGS. 17 and 18 are schematic views illustrating a cleaning device in accordance with another embodiment of the present invention; and

FIGS. 19 and 20 are sectional views illustrating the operation of a valve utilized in the above embodiment.

BEST MODE FOR CARRYING OUT THE INVENTION

Referring now to FIGS. 1 and 2, there is shown a cleaning device for cleaning a hair removing apparatus, for example, a dry shaver **10** or epilator with the use of a cleaning liquid. The device has a housing **20** with a base **30** and a stand **40** upstanding from a rear end of the base. Formed at the front end of the base **30** is a basin **50** which is configured to receive an operator head, i.e., a shaver head **12** of the shaver **10**. The cleaning liquid is stored in a tank **100** detachably mounted to the stand **40** and is connected to the basin **50** for supplying the liquid into the basin and for recovering the liquid therefrom. The device includes a pump **70** which is controlled to circulate the cleaning liquid between the tank **100** and the basin **50** for cleaning the shaver head **12**. The cleaning operation continues for a predetermined period. Thereafter, a control is made to collect the liquid from the basin **50** into the tank **100**, details of which will be discussed later. Upon recovery of the liquid into the tank, a fan **200** is actuated to produce a forced air flow over the head **12** for drying the same.

As shown in FIG. 2, a drip pan **60** is disposed immediately below the basin **50** for collecting the liquid dripping and/or overflowing from the basin **50**. The drip pan **60** has a top opening which communicates with a drain port **52** at the bottom center of the basin **50**, and also with an overflow duct **34** leading to an

upper edge of the basin **50**. The drip pan **60** has a filter **63** for entrapping contaminants dislodged from the shaver head **12** and carried on the liquid dribbling through the drain port **52** into the drip pan **60**. The liquid thus cleared of the contaminants is fed through a connection port **65** to a fluid intake channel **22** leading to the tank **100**. The pump **70** is disposed in the fluid intake channel **22** for drawing the liquid from the basin **50**. The fluid intake channel **22** is open to the atmosphere through the drain port **52**, the overflow duct **34**, and also through an air vent **36** formed in the base **30** around the basin **50**. Thus, depending upon the level of the liquid in the basin **50**, the outside air is drawn alone or together with the liquid by the action of the pump **70** into the tank **100** through the fluid intake channel **22**. The tank **100** is provided in the form of a hermetically sealed container having an inlet and an outlet. The inlet is defined by a fluid inlet tube **102** which is detachably connected to the fluid intake channel **22** for taking in the liquid and/or the air. The outlet is defined by a liquid outlet tube **104** which is detachably connected to a liquid supply channel **24** formed in the housing **20** and leading to a spout **25** upwardly of the basin **50**, as best shown in FIG. 9, for flowing the liquid down into the basin **50**. Turning back to FIG. 2, the liquid outlet tube **104** is connected to a U-shaped sucking tube **105** which extends deep into the tank **100** to a point adjacent to the bottom of the tank for sucking the liquid. Further, the tank **100** is formed with an air exhaust tube **106** detachably connected to an air exhaust channel **26** which extends within the housing **20** and is open to the atmosphere through ventilation windows **29** or clearances in the walls of the housing **20**. An air valve **80** is disposed in the air exhaust channel **26** to selectively close the tank and open it to the atmosphere. The air valve **80** is realized by a normally-closed electromagnetic valve which

opens upon being energized or supplied with an electric current. A cap **112** is detachably and sealingly mounted in a filling port **110** in the upper end of the tank **100** for replacing or replenishing the liquid.

Now, the operation of the device is discussed with reference to FIGS. 2 and 5. The device includes a power supply **90** providing an electric power to various electrical parts, and a controller **92** responsible for controlled operations of the associated parts. When a switch **94** is activated, the controller **92** responds to provide a supply mode and a recovery mode in sequence. In the supply mode, the pump **70** is activated with the air valve **80** being kept closed, i.e., the tank being kept hermetically sealed. Initially, the basin **50** is substantially free from the liquid such that only the air is drawn and accumulated in the tank **100** to increase the inside air pressure. As the air pressure increases, the liquid in the tank **100** is forced to expel out through the liquid outlet tube **104** and the liquid supply channel **24** into the basin **50**. In this connection, it is noted that the drain port **52** of the basin **50** is dimensioned such that the flow rate of the liquid dripping into the drip pan **60** is smaller than that of the liquid being supplied from the tank **100**, thereby increasing the amount of the liquid in the basin **50**. After the basin **50** is filled with the liquid, an extra amount of the liquid is caused to overflow into the drip pan **60**, maintaining the liquid in the basin **50** at a constant level. In this connection, the air is continuously drawn into the tank with the superfluous liquid to keep supplying the liquid into the basin **50**, i.e., circulating the liquid between the tank **100** and the basin **50** for cleaning the shaver head **12**. The supply mode continues over a predetermined time period during which the shaver head is activated intermittently or continuously to shake the contaminants off, enhancing the cleaning effect.

The supply mode is automatically followed by the recovery mode in which the pump **70** is activated with the air valve **80** kept opened to collect the liquid from the basin **50** through the drip pan **60** into the tank **100**. With the air valve **80** being opened, i.e., the tank **100** opened to the atmosphere, the air drawn by the pump **70** is exhausted through the air valve **80** so as to recover the liquid and collect only the liquid in the tank **100**. The recovery mode continues over a predetermined time period to collect the whole liquid into the tank. Near the end of the period, the shaver head is controlled to be activated for shaking the liquid off. Thereafter, the fan **200** is activated to dry the shaver head with or without the shaver head being actuated. Thus, the supply mode and the recovery mode are accomplished with the use of a single pump and the air valve.

As schematically shown in FIG.3, the tank **100** is L-shaped to have a wide header section **114** and a vertically elongated section **116** overlapping the rear face of the stand **40**. The tank **100** is mounted on the housing **20** with the horizontal section **114** resting on a mounting face **41** on top of the stand **40**. The fluid inlet tube **102**, the liquid outlet tube **104**, and the air exhaust tube **106** are integrally formed with the tank **100** to project on the bottom of the header section **114** for detachably connection with the fluid intake channel **22**, the liquid supply channel **24**, and the air exhaust channel **26**, respectively. For this purpose, the ends of the channels **22**, **24**, and **26** are integrated into a combination socket **28** formed in the mounting face **41**, as shown in FIG. 10. Thus, the tank **100** can be attached to the housing **20** from the above.

The device further includes a filter detector **98** which issues a stop signal when the drip pan **60** is not in position below the basin **50**. In response to the stop signal, the controller **92** deactivates the pump **70** and the associated parts to

cease the above operation. A display **96** is included in the device to give information about which one of the supply mode and the recovery mode is proceeding, and the elapsed time. Further, a signal transmitting terminal **91** is provided on the side of the housing **20** for transmitting an electric signal that is received in a shaver controller **14** to activate the shaver head **12** or a charging circuit **16** for charging a battery **15**. As best shown in FIGS. 6 and 7, the terminal **91** includes a set of contacts **93** exposed on the front wall of the stand **40** for contact with a corresponding set of pads **13** formed on the exterior of the shaver **10**. The pads defines a signal receiving terminal **11** represented in FIG. 5 through which the signal is transmitted to the shaver controller **14**. The contacts **93**, i.e., the terminal **91** is located intermediate the height of the stand **40** for intimate contact with the pads **13** or the receiving terminal **11** when the shaver **10** is held upside down to place the shaver head **12** into the basin **50**. Alternatively, the signal transmitting terminal **91** may be in the form of a primary winding for transformer coupling with a secondary winding placed within the shaver as the signal receiving terminal **11**. In this modification, both of the windings can be concealed within the housing and shaver, respectively.

As shown in FIG. 6, the stand **40** carries a holding means, i.e., a mechanism of holding the shaver **10** in position. The mechanism includes a pair of clasps **42** which are spaced widthwise with respect to the height dimension of the housing **20** and are pivotally supported to the stand **40** to be movable between a holding position of bracing the shaver **10** and a releasing position permitting the removable of the shaver. The clasps **42** are biased by coil springs **43** to the holding position in which the clasps **42** engage the opposite sides of the shaver **10**. Each of the clasps **42** is formed at its upper and lower

end respectively with inclined guides **44** for sliding contact with tapered head sides **18** as well as top tapered sides **19** adjacent to the shaver head **12**, as shown in FIG. 4. Thus, the clasps **42** can be forced to open temporarily in the release position when the shaver is moved vertically to place the shaver head **12** into the basin **50**, allowing the easy attachment of the shaver, after which the clasps close by the action of the springs into the holding position. Also, when the shaver is moved vertically to pull the shaver head **12** out of the basin **50**, the clasps **42** are forced to open by contact with the top tapered sides **19** of the shaver, permitting the easy detachment of the shaver from the device. In the holding position, the clasps **42** urges the shaver **10** towards the stand **40** in order to keep the pads **13** of the receiving terminal **11** pressed against the corresponding contacts **93** for reliable signal transmission therebetween.

As shown in FIGS. 7 to 9, the stand **40** has a front face which is configured to guide the apparatus **10** to a holding position where the shaver head **12** is received within the basin **50**. For this purpose, the front face has is a guide face **46** which is inclined with respect to a vertical or height axis of the housing **20** and which is formed at its lower end with a stopper **48** for abutting against a shoulder of the apparatus or shaver **10**. The stopper **48** is positioned so that the apparatus **10** is caused to lean upon the front face of the stand by its own weight, thereby urging the pads **13** of the receiving terminal **11** against the contacts **93** of the transmitting terminal **91** for reliable electrical contact therebetween. In this sense, the electrical connection can be made successfully even without relying upon the springs **43** of the clasps **42**.

The drip pan **60** is made detachable to the housing **20** for easy cleaning of the filter **63** as well as the pan **60** itself. As shown in FIGS. 7, 8, and 14, the

drip pan **60** is provided in the form of a drawer having a front handle **64** and the top opening which comes into fluid communication with the drain port **52** of the basin **50**, the air vent **36**, and the overflow duct **34** for receiving the liquid and/or the air therethrough. A recess **32** is formed at the front end of the base **30** immediately below the basin **50** to accommodate the drip pan **60**. The inner bottom of the pan **60** is inclined downwardly towards the connection port **65** for smoothly guiding the liquid to the fluid intake channel **22**. As shown in FIG. 14, the interior space of the drip pan **60** is divided by the filter **63** into a first chamber **61** and a second chamber **62**. The first chamber **61** is in direct open communication with the drain port **52** and the overflow duct **34** for collecting the liquid and/or the air respectively therethrough, thereby depositing the contaminants carried by the liquid on the filter **63**. The second chamber **62** is in direct open communication with the air vent **36** and with the connection port **65** for feeding the liquid cleared of the contaminants as well as the outside air into the fluid intake channel **22**. For this purpose, the filter **63** is bent into an L-shaped section, as shown in FIG. 14. With this arrangement, the vertical portion of the filter **63** can be located above the level of the liquid in the drip pan **60** so as to entrap the contaminants possibly carried by the air drawn through the drain port **52** in the initial stage of the supply mode as well as in the last stage of the recovery mode. Alternatively, the filter **63** may be made flat, as shown in FIG. 15, so that the second chamber **62** communicates with the air vent **36** through the filter **63**. In this modification, the filter **63** can entrap contaminants carried by the air drawn also through the air vent **36**.

The pan **60** is formed with an electrode (not shown) which is sensed by the filter detector to determine the presence of the drip pan in the recess **32**. In

any case, the drip pan **60** is designed to have a liquid storing capacity larger than that of the basin **50** in order to collect the entire volume of the liquid from the basin **50** even if the pump **70** should stop during the supply mode. The filter is preferred to have a filtering area of 700 mm^2 or more. Further, instead of providing the removable drip pan **60**, the filter **63** alone may be detachable to the housing for frequent cleaning purpose.

In the above embodiment, the tank **100** is spaced laterally from the basin **50** with regard to the height dimension or axis of the housing **20** so as not to add an extra height to the device. However, since the tank **100** can be relatively freely located without regard to the position of the basin **50**, it is easy to design the device as shown in FIG. 16, in which the tank **100** is configured to have its major portion, i.e., a vertical section **121** disposed laterally from the basin **50**, while locating a horizontal section **122** underneath the drip pan **60**. It should be noted that the above spatial arrangements of the tank **100** and the basin **50** are disclosed only for exemplarily purpose, and the present invention should not be interpreted to be limited thereto.

FIGS. 17 and 18 illustrate a cleaning device in accordance with another embodiment of the present invention which is basically identical to the above embodiment except that a liquid feed valve **82** is utilized in addition to the air valve **80A**. Like parts are designated by like reference numerals with a suffix letter of "A". The pump **70A** is disposed in the liquid supply channel **24A** to draw the cleaning liquid out of the tank **100A** and supply the liquid into the basin **50A**. The liquid feed valve **82** is disposed in the liquid supply channel **24A** upstream of the pump **70A** for enabling and disabling the liquid feed from the tank **100A** into the basin **50A**. The air valve **80A** is dispose in an air exhaust

channel **26A** which leads from the tank **100A** and merges into the liquid supply channel **24A** at the pump **70A**, and is therefore open to the atmosphere through the spout **25A** at the open end of the liquid supply channel **24A**. The liquid feed valve **82** and the air valve **80A** are controlled by the controller to be actuated in synchronous with each other to give the supply mode of feeding the liquid from the tank **100A** and the recovery mode of collecting the liquid into the tank **100A**, selectively. In the supply mode, the air valve **80A** is kept closed and the liquid feed valve **82** is kept opened, as shown in FIG. 17, allowing the pump **70A** to draw the liquid out of the tank **100A** into the basin **50A**, while sucking the liquid from the drip pan **60A** through the fluid intake channel **22A**. In the recovery mode, as shown in FIG. 18, the air valve **80A** is kept opened and the liquid feed valve **82** is kept closed. With this result, only the air is expelled by the pump **70A** through the air exhaust channel **26A** and the liquid supply channel **24A**, thereby vacuuming the tank **100A** to collect the liquid from the basin **50A** through the drip pan **60A** and the fluid intake channel **22A**. Each of the valves **80A** and **82** is in the form of an electromagnetically actuated valve which, as shown in FIGS. 19 and 20, includes an electromagnet **130** and a piston **132** that acts on a flexible tube constituting each one of the channels **26A** and **24A** for selectively closing and opening the tube or channel by the controller.

The cleaning device in accordance with the present invention can be equally applied for cleaning the epilating head of a hand-held epilator or other operator head of similar hair removing apparatus.